

REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 1-13 are presently pending in this application, Claim 13 having been newly added by the present amendment.

In the outstanding Office Action, Claims 6 and 9-12 were rejected under 35 U.S.C. §102(b) as being anticipated by Jullian et al. (U.S. Patent 5,863,315); and Claims 1-5, 7 and 8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Jullian et al. in view of Kulprathipanja (U.S. Patent 5,900,523).

Newly added Claim 13 is believed to find clear support in the specification, claims and drawings as originally filed. For example, Claim 13 is believed to be supported by Claim 1 and page 4, lines 19-21, describing that the adsorptions are carried out preferably at a temperature of from 20 to 180°C and at a pressure of from 1 to 10 bar, and pages 6-7, describing that the experimental tests are carried out at a temperature of about 160°C and at a pressure of about 1.1 bar.

Briefly recapitulating, Claim 6 of the present application is directed to a process for separating mixtures of hydrocarbon isomers in gas phase on molecular sieves, and the process includes the steps of providing a plurality of columns each including molecular sieves and configured to function alternately such that the columns are designated to function from a secondary adsorption device, to a primary adsorption device, and to a desorption device in sequence, feeding the mixtures of hydrocarbon isomers to at least one of the columns functioning as the primary adsorption device such that isomers with a greater selectivity towards the molecular sieves in the mixtures of hydrocarbon isomers are adsorbed, feeding an

entire effluent of the mixtures of hydrocarbon isomers from the at least one of the columns functioning as the primary adsorption device to at least one of the columns functioning as the secondary adsorption device such that remaining of the isomers with a greater selectivity towards the molecular sieves are adsorbed, discharging isomers with a lower selectivity towards the molecular sieves in the mixtures of hydrocarbon isomers from the at least one of the columns functioning as the secondary adsorption device and a desorbing agent remaining therein, feeding a desorbing agent to at least one of the columns functioning as the desorption device, discharging isomers with a greater selectivity towards the molecular sieves in the mixtures of hydrocarbon isomers and the desorbing agent in the at least one of the columns functioning as the desorption device, and rotating the columns from the secondary adsorption device, to the primary adsorption device, and to the desorption device in sequence.

The outstanding Office Action asserts that Jullian et al. disclose the process as recited in Claim 6. However, Jullian et al. are not believed to teach “feeding an *entire* effluent of the mixtures of hydrocarbon isomers from the at least one of the columns functioning as the primary adsorption device to at least one of the columns functioning as the secondary adsorption device such that remaining of the isomers with a greater selectivity towards the molecular sieves are adsorbed; ... and rotating the columns from the secondary adsorption device, to the primary adsorption device, and to the desorption device in sequence” as recited in Claim 6 (emphasis added in *Italic*). On the other hand, in the Jullian et al. process, only a portion of the effluent is extracted to conduct the second pressurization step.¹ In addition, the adsorption phase is performed in only one column. It is thus respectfully submitted that the process recited in Claim 6 is believed to be distinguishable from Jullian et al.

¹ See Jullian et al., column 3, lines 60-64.

Turning now to Claim 1, Claim 1 of the present invention is directed to a process for separating mixtures of hydrocarbon isomers in gas phase on molecular sieves, and the process includes the steps of providing a plurality of columns each including molecular sieves and configured to function alternately such that the columns are designated to function from a secondary adsorption device, to a primary adsorption device, and to a desorption device in sequence, feeding the mixtures of hydrocarbon isomers to at least one of the columns functioning as the primary adsorption device such that isomers with a greater selectivity towards the molecular sieves in the mixtures of hydrocarbon isomers are adsorbed, feeding an entire effluent of the mixtures of hydrocarbon isomers from the at least one of the columns functioning as the primary adsorption device to at least one of the columns functioning as the secondary adsorption device such that remaining of the isomers with a greater selectivity towards the molecular sieves are adsorbed, discharging isomers with a lower selectivity towards the molecular sieves in the mixtures of hydrocarbon isomers from the at least one of the columns functioning as the secondary adsorption device and a desorbing agent remaining therein, feeding a desorbing agent to at least one of the columns functioning as the desorption device, discharging isomers with a greater selectivity towards the molecular sieves in the mixtures of hydrocarbon isomers and the desorbing agent in the at least one of the columns functioning as the desorption device, feeding the isomers with a lower selectivity towards the molecular sieves and the desorbing agent discharged from the at least one column functioning as the secondary adsorption device to a first distillation unit configured to recover the desorbing agent for recycling for the at least one column functioning as the desorption device, feeding the isomers with a greater selectivity towards the molecular sieves and the desorbing agent discharged from the at least one of the columns functioning as the desorption device to a second distillation unit configured to recover the desorbing agent for recycling for the at

least one of the columns functioning as the desorption device, and rotating the columns from the secondary adsorption device, to the primary adsorption device, and to the desorption device in sequence. By feeding the mixture of hydrocarbon isomers and rotating the columns as such, one cycle of the columns in the process is conducted in only three phases, thereby achieving a simplified system with a higher adsorption yield of the extracted product.

The outstanding Office Action asserts that the process as recited in Claim 1 is obvious from Jullian et al. and Kulprathipanja. However, it is respectfully submitted that the combination of these cited references is believed to be improper. Specifically, Jullian et al. disclose a process for separating hydrocarbons mixtures wherein the hydrocarbon mixture is sent to an adsorption zone in *vapour phase*, while Kulprathipanja discloses a process for separating metaxylene from a mixture of C₈ aromatic hydrocarbons in which the mixture is sent to an adsorption zone in *liquid phase*. These two references differ in the phase of the adsorption step (vapour phase versus liquid phase). It is thus believed to be inappropriate to modify the Jullian et al. process by adding a step (namely the separation of the desorbing agent) of the Kulprathipanja process that carries out the adsorption with a different phase. Furthermore, in the Kulprathipanja process, the desorbing agent is not present in the feed mixture. On the other hand, Jullian et al. disclose the process in which the desorbing agent, consisting of isobutane, n-butane, isopentane and n-pentane, is already present in the feed charge and it is an integral part of the separated product.² Therefore, there is no reason to submit it to a separation to use it again in the system, i.e., it has no meaning at all to submit the obtained product to any separation when the desorbing agent to be separated is the same component of the wished mixture, and the combination of these processes is believed to be improper. Even assuming *arguendo* that Jullian et al. and Kulprathipanja are combined, the

² See *id.*, examples 1 and 2.

combined teachings are not believed to render the process recited in Claim 1 obvious, since the adsorbing and desorbing in the process of Claim 1 are performed without pressure change. For example, in the examples 1-4 presented in the Applicants' specification, the experimental tests are carried out at a temperature of about 160°C and at a pressure of about 1.1 bar. In the examples 5-6, the laboratory unit is placed in an oven to maintain the temperature of about 160°C required by the experimentation. It is thus clear that both temperature and pressure are maintained constant during the entire process. In contrast, according to Jullian et al., each column during the nine phases is first pressurized, then depressurized and then again pressurized.³ Furthermore, significant differences from Jullian et al. are clearly shown by the comparison data provided in Attachments A-C. In the two examples of Jullian et al., a recovering of i-paraffin equal to 59.4% and 56.7% with a title respectively equal to 88.6 and 87.1% is obtained, while in the example according to the process of Claim 1, a recovery of ethylbenzene of 56% with a title of 99.9% is obtained. It is therefore evident from these data that the process according to Claim 1 of the present application allows one to obtain a purer product. Therefore, the process recited in Claim 1 is believed to be distinguishable from Jullian et al. and Kulprathipanja.

Likewise, independent Claim 13 includes subject matter substantially similar to what is recited in Claim 13 to the extent discussed above. Thus, Claim 13 is also distinguishable from Jullian et al. and Kulprathipanja.

For the foregoing reasons, Claims 1, 6 and 13 are believed to be allowable. Furthermore, since Claims 2-5 and 7-12 depend ultimately from either Claim 1 or 6, substantially the same arguments set forth above also apply to these dependent claims. Hence, Claims 2-5 and 7-12 are believed to be allowable as well.

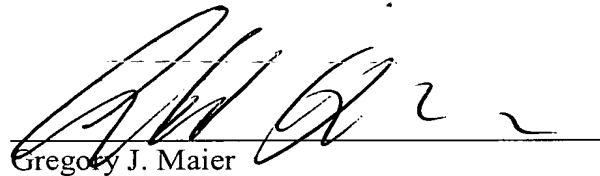
³ See *id.*, column 17, lines 4-46.

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In view of the amendments and discussions presented above, Applicants respectfully submit that the present application is in condition for allowance, and an early action favorable to that effect is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

A handwritten signature in black ink, appearing to read 'Gregory J. Maier', is written over a horizontal line.

Gregory J. Maier
Attorney of Record
Registration No. 25,599

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/03)

Akihiro Yamazaki
Registration No. 46,155

GJM/AY/YO:mda:fm
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Attachment A

Example 1, Jullian et al.

4 columns

12 sequences

[illegible]

Attachment B

Example 2, Jullian et al.

3 columns

9 sequences

DES		MIX		REFINED		EXTRACTED		MIX	REF
%p	Kg/h	%p	Kg/h	%p	Kg/h	%p	Kg/h		
4.25	0.286	1.39	0.273	1.78	0.245	2.57	0.314	l-paraff	14.635
3.39	0.228	1.02	0.200	1.31	0.180	2.03	0.249	n-paraff	5.015
92.26	6.218	27.99	5.500	36.08	4.968	55.24	6.750		
0.10	0.007	11.20	2.201	2.45	0.337	15.30	1.870		
		11.30	2.220	12.33	1.698	4.28	0.523		
		4.80	0.943	5.24	0.722	1.18	0.222	MIX+DES	
		14.60	2.869	15.93	2.194	5.53	0.675		
		8.70	1.710	9.50	1.308	3.28	0.401	l-paraff	21.140
		6.10	1.199	1.31	0.180	8.33	1.018	n-paraff	5.250
		2.00	0.393	2.18	0.300	0.76	0.093		26.390
		5.70	1.120	6.22	0.856	2.16	0.264		
		5.20	1.022	5.67	0.781	1.97	0.241		
100.00	6.74	100.00	19.65	100.00	13.77	103.27	12.62	Recovery Title	56.7% 87.1%

3 columns

MIX+DES

56.00%
99.9%